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See revised edition

HOW TO GROW AN ACRE OF POTATOES

TO GROW A GOOD CROP OF POTATOES

SELECT A SOIL that works easily, that is well supplied with humus, and is not subject to drought.

Apply plant food liberally.

Plow as deep as possible, 8 to 10 inches if the surface soil will permit.

Conserve soil moisture by disking fall-plowed land in early spring and the spring-plowed land as soon as plowed.

Put the soil in the best possible shape before planting.

Plant a variety adapted to your locality and soil.

Use the best seed obtainable.

Disinfect the seed potatoes before cutting them.

Cut blocky seed pieces, weighing from 1 to 2 ounces.

After planting keep the surface of the ground loose and friable until the plants appear.

After the plants appear give deep cultivation. Cultivate often enough to keep the soil loose and the weeds destroyed.

Prevent injury to the plants from disease or insect pests by spraying them with suitable fungicides and insecticides.

If you live where it is possible to produce good seed, improve your stock by systematic selection of tubers from the best-producing plants. This should be done in the field, by hand digging a goodly number of promising-looking plants.

Increase your returns from the crop by carefully grading it.

Washington, D. C.

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HOW TO GROW AN ACRE OF POTATOES

[PREPARED ESPECIALLY FOR USE IN BOYS' AND GIRLS' CLUB WORK]

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FOREWORD

THE REMARKABLE SUCCESS which has attended the efforts of those who have been instrumental in organizing and directing boys' and girls' club work in this country is a splendid tribute to the leaders in this movement and proof of the hearty cooperation which they have received from those boys and girls whom they have enlisted in the work. When a boy or a girl succeeds in raising a plat of potatoes yielding at the rate of 300 to 600 or more bushels per acre, as many of them have done, it is a source of inspiration to those of their club who have been less fortunate and, what is perhaps of greater importance, an object lesson to their elders as to what can be accomplished when the crop is given proper cultural attention.

If all boy and girl club members were able to produce as large crops of potatoes as have been mentioned, there would be little necessity for suggestion on "How to grow an acre of potatoes." It is assumed, however, that many members of these clubs have at one time or another found themselves face to face with problems which they were only partially able to solve. A poor stand of plants, the presence of certain insect pests or of fungous diseases attacking different parts of the plant, or poor yields from promising-looking plants may have served to dampen the youthful ardor of some members. The aim of this bulletin is to aid those who may have been confronted with these or other difficulties to meet and overcome them more successfully, to the end that their efforts may be crowned with a well-deserved success.

INCREASED PRODUCTION DESIRABLE

The average production of potatoes in the United States for the five years from 1926 to 1930, inclusive, was 112.9 bushels per acre. During the same period the State of Maine produced an average of 250.3 bushels per acre, or 112.8 per cent more than the average of the entire United States. When it is remembered that commercial yields of 500 to 600 bushels per acre are by no means uncommon in this country and that on small areas (an acre or less) much larger yields have been obtained by boys and girls belonging to agricultural clubs, one can readily see that there is plenty of opportunity for increasing the per-acre production of potatoes in the United States.

Heretofore potato production in this country has been conducted along extensive rather than intensive lines. In other words, we have been satisfied to plant twice as many acres as should have been necessary to produce a sufficient quantity of potatoes for our food requirements. Present economic conditions compel the grower to consider more seriously the desirability of reducing the cost of production by increasing the yield per acre. Increased production per acre at a reduced cost per bushel should be the goal of every potato grower in this country. The successful accomplishment of this result is dependent upon many factors, the chief of which are (1) the selection of a suitable soil, (2) the proper preparation of the soil, (3) the selection of the right varieties for the locality in which they are to be grown, (4) the planting of high-grade seed stock, (5) an abundant supply of plant food, (6) good tillage, and (7) thorough protection of the plants against fungous diseases, insects, and other pests.

SELECTION OF SUITABLE SOIL

While the potato is probably as easily satisfied in its soil requirements as any other food plant, it thrives better on some soils than on others. Gravelly or sandy loam soils are generally considered especially well suited to the production of large crops, provided they are well drained and well supplied with plant food. A very light sandy soil or a stiff clay soil should be avoided when selecting land for potatoes if large yields are desired. The ideal soil is one that does not run together in heavy rains, that works easily, that is well supplied with humus (decaying vegetable matter), and that while well drained is naturally supplied with sufficient moisture to keep the plants in a thrifty growing condition. Clover or alfalfa is generally regarded as the best preparatory crop for potato land. Either of these crops furnishes a goodly supply of humus when turned under and materially increases the moisture-holding capacity of the soil.

The economical production of an acre of potatoes is dependent to a certain extent upon its shape. For example, the longer the rows are the more economically they can be planted, cultivated, and sprayed, because long rows entail less turning and therefore less lost motion. Sixteen rows 3 feet apart and 907½ feet long represent one acre and are of a suitable length to till.

PREPARATION OF THE SOIL

The land should be plowed as deeply as the character of the surface soil will permit. If the surface soil is 10 inches deep, plow it to

that depth or a little more. If it is only 6 inches deep, plow it 6½ to 7 inches deep. The aim should be to plow from one-half to one inch deeper than formerly, in order to increase the depth gradually and thereby augment the water-holding capacity of the soil.

Generally speaking, land that is intended for potatoes should be plowed preferably in the autumn. There are exceptions, however, to such a practice, as in the case of land that is likely to wash badly from winter rains or melting snows, or on which the crop is not to be planted until rather late in the season. In the last case it may be possible to turn under a considerable growth of clover or alfalfa by delaying the plowing until shortly before the planting season.

If plowed in the fall, it should be disked or harrowed as early in the spring as possible, in order to conserve the moisture accumulated during the winter or early spring and to prevent weed growth. The object should be to maintain a surface mulch of loose soil after each beating rain. When plowed in the spring, disk it immediately, in order to prevent the possible baking of the newly turned soil and to conserve the moisture.

In preparing the seed bed, spare no pains to fine the soil and to put it in as friable a condition as possible. To do this may require the use of a cutaway or disk harrow, a spring-tooth harrow, and a smoothing harrow, followed with a plank drag if the surface is slightly uneven or lumpy. Thoroughness in the preparation of the seed bed is as essential to the successful production of a large crop as in any other step in the process. In fact, if the crop is planted on land that is poorly prepared, no amount of subsequent cultivation will entirely remedy the defect.

SELECTION OF THE RIGHT VARIETY

Select a variety that is known to be adapted to your section and that meets the requirements of the market in which it is to be sold. If you are in doubt as to the best variety to grow, consult your county agent. The following list includes what may be considered the leading commercial varieties grown in the United States at the present time:

Early-maturing varieties.—Irish Cobbler (fig. 1), Triumph (fig. 2), Early Ohio, Spaulding No. 4 (*Rose No. 4*).

Medium or late maturing varieties.—Burbank, Russet Burbank, Green Mountain, Rural, Russet Rural, Peerless, McCormick, Jersey Red Skin, Perfect Peachblow (*Red McClure*), Charles Downing (*Idaho Rural*), Prolific (*Brown Beauty*).

The Irish Cobbler is grown extensively as an early truck crop in the Atlantic Coast States north of Florida, in the Louisville (Ky.) district, and in the Kaw Valley in Kansas. It is principally grown for seed purposes in northern Maine, Vermont, and New York; also to some extent in Wisconsin, Minnesota, and North Dakota; in fact, it is grown more or less in practically every State in the Union.

The Triumph is extensively grown as an early truck crop in southern Florida, Alabama, Mississippi, Louisiana, Texas, Oklahoma, and Tennessee. For seed purposes it is grown in the northern part of Maine, Wisconsin, Minnesota, North Dakota, Montana, and northwestern Nebraska. It thrives best in a cool moist climate.

The Early Ohio is most largely grown for table purposes along the Ohio River in West Virginia, in Ohio, Illinois, Missouri, Wis-

consin, Minnesota, North Dakota, South Dakota, and Nebraska, and less extensively in Kansas and Colorado. The seed-production centers are in the Red River Valley in Minnesota, in North Dakota and South Dakota, and to some extent in northern Wisconsin. The Early Ohio is also grown to a lesser extent in other sections.

Spaulding No. 4 is grown almost exclusively as a truck crop in the central and northern portions of Florida, and for seed purposes in Aroostook County, Me. A variety known as King is so nearly like Spaulding No. 4, if not identical with it, that it is frequently substituted for it. This variety is grown to a considerable extent in northern Wisconsin and Minnesota, and to a less extent in northwestern Nebraska. The King variety seems to be especially well adapted to light soils.

The Burbank and Russet Burbank are grown most extensively in Colorado and States west to the Pacific coast. The Russet Burbank

FIG. 1.—Upper and side views of a fair type of Irish Cobbler seed potato

is grown to some extent for seed purposes in the north-central portion of Minnesota.

The varieties belonging to the Green Mountain group, which includes the Green Mountain, Gold Coin, Norcross, and Delaware, are grown most extensively in the New England States, northern New York, on Long Island, in New Jersey, northwestern Maryland, Pennsylvania, northern Wisconsin, and Minnesota, and to a less extent in the mountainous sections of Virginia, West Virginia, North Carolina, and South Carolina. These varieties are especially sensitive to heat and drought, and should be planted only where the summer temperature is relatively low and the rainfall ample. They are heavy yielders and the tubers are of high table quality.

The Rural and Russet Rural varieties represent a strong, vigorous-growing race of potatoes embodying such varieties as the Rural New Yorker No. 2, Sir Walter Raleigh, Carman No. 3, and numerous others. They are grown most extensively in western New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, Iowa, Wisconsin, Minnesota, and Colorado. The Russet Rural is an especial favorite

in Michigan and is gaining favor in New York and Pennsylvania. It is grown to some extent as a fall crop in mountainous sections of the South.

The McCormick variety is exclusively grown in the South as a fall crop. It is most largely grown in Virginia, North Carolina, South Carolina, Tennessee, and Georgia. In the latter States it is known under the names of Lookout Mountain and Hoosier. It is especially resistant to heat and drought and is the surest late-crop variety that can be grown in the South. Unfortunately it is a deep-eyed low-quality potato.

The Jersey Red Skin has the same heat-resistant and drought-resistant characteristics as the McCormick. It has shallow eyes and possesses better table quality. This variety is rapidly displacing the McCormick in Maryland and in Virginia.

The Perfect Peachblow (*Red McClure*) is perhaps the least extensively grown of all the varieties listed, being practically restricted to the Carbondale and Eagle districts in Colorado. When well

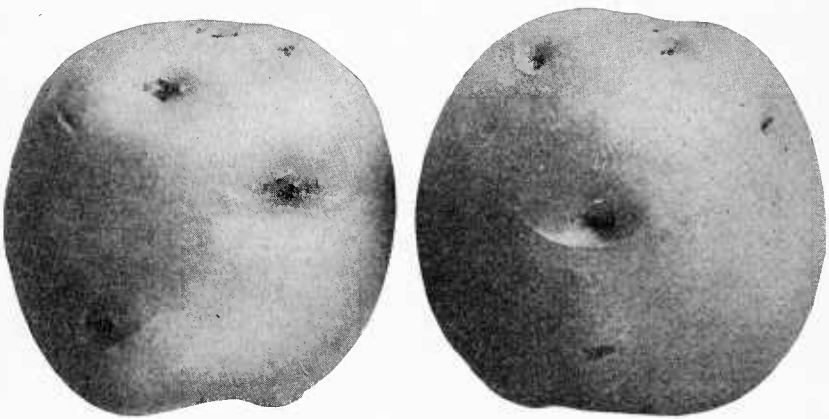

FIG. 2.—Extra-fine specimens of Wisconsin grown Triumph seed potatoes

grown it is a handsome and prolific variety, but it has a very limited range of adaptability.

The Charles Downing (*Idaho Rural*) potato is grown most extensively in southern Idaho, in which region it is commonly spoken of as the Rural or Idaho Rural. In Colorado it is usually called the Charles Downing, though in some localities where recently introduced it is called Idaho Rural. The variety sets a heavy crop of tubers and must have a good supply of moisture and plant food if a large percentage of the tubers is to reach marketable size. It is best adapted to the irrigated regions of the West.

Prolific is a variety that has become very popular in the San Luis Valley in Colorado. It is a heavy producer of tubers of medium size. It is known to the trade as Brown Beauty.

HIGH-GRADE SEED STOCK

High-grade seed stock may be defined as seed that is true to name, produced by strong healthy plants that have developed a goodly number of tubers of even, marketable size and uniform shape, and that is partially unripe when harvested.

The boy or girl who fails to recognize the necessity of using good seed can not hope to produce a very large crop. Recent studies have shown that there is a very considerable variation in the productive capacity of different strains of supposedly high-grade seed of the same commercial variety. These studies, which were undertaken in 1919 by the United States Department of Agriculture in cooperation with the Wisconsin Agricultural Experiment Station at the Spooner branch station, showed a variation in the yield of nine strains of Triumph potatoes ranging from 116 to almost 223 bushels of marketable tubers per acre, or a difference in yield of 107 bushels between the lowest and the highest producing strains. These results are not at all unusual, as may be judged from some tests made at an earlier date by the Canadian Department of Agriculture on the experimental farm at Kentville, Nova Scotia, where some 15 strains of the Garnet Chili potato secured from as many different growers in various parts of Nova Scotia, New Brunswick, and Prince Edward Island were tested as to their productiveness. The yields ranged from $55\frac{3}{10}$ to 236 bushels of marketable potatoes, or a variation of nearly 181 bushels per acre. Many other similar examples might be cited, but these should serve to convince us that there may be just as great variations in the productive capacity of different strains, due largely, we believe, to the presence of heritable diseases in the seed stock, as between the milk and butter yielding capacities of individual milk cows of the same breed. The use of certified seed potatoes is recommended. For more detailed information, consult Farmers' Bulletin 1332, Seed Potatoes and How to Produce Them.

PLANT FOOD SUPPLY

A maximum crop can be produced only when the soil in which they are grown is well supplied with available plant food. If a good clover, alfalfa, cowpea, soybean, or other leguminous crop has been turned under, a much smaller application of commercial fertilizers or barnyard manures will be necessary than if the preceding crop was a grain crop. In the early truck-crop sections of the South many of the growers apply a ton or more of a 7–6–5 fertilizer [1] to the acre. The southern truck grower tries to start his early crop as quickly as possible by using a large amount of nitrogen (usually called ammonia) to stimulate stem and leaf growth, thereby securing a strong, vigorous plant. As a rule, fertilizer applications in the South vary from 1,500 to 2,500 pounds per acre. The New Jersey, Long Island, and Maine growers use quantities equally as large as the southern growers, but with slightly different percentages of nitrogen, phosphoric acid, and potash.

FERTILIZER ANALYSES

The following standardized fertilizer analyses are recommended for three types of soil—sandy, loam, and clay—in the southeastern, eastern, and western sections of the United States:

[1] The common way of stating the chemical analysis of a commercial fertilizer is to give the percentage of nitrogen first, then the phosphoric acid, and lastly the potash. Thus, a 7–6–5 fertilizer means 7 per cent of ammonia (5.76 per cent nitrogen), 6 per cent of phosphoric acid, and 5 per cent of potash.

TABLE 1.—*Standard fertilizer mixtures, showing the proportion of nitrogen, phosphoric acid, and potash recommended for three types of soil*[1]

Soil	Southeastern States		Eastern States	Western States
	Early crop	Second, or winter, crop	Late crop	Late crop
Sandy	7–6–5	2–10–6	5–8–7	3–10–4
Loam	5–8–5	2–10–6	4–8–6	3–10–2
Clay	4–8–4		4–8–4	3–12–0

[1] See the footnote on p. 6

An intelligent choice of a commercial fertilizer must take into consideration the previous treatment of the land and its present fertility. In fields where previous crops of potatoes have shown a tendency to scab, barnyard manure is likely to increase this disease and in such cases should be used sparingly and applied to the crop of the preceding year rather than directly to the potato crop. In the eastern and southeastern sections of the United States it is more economical, as well as more desirable, to supplement barnyard manures with a light application of a low-grade commercial fertilizer analyzing approximately 2 per cent of nitrogen, 12 per cent of phosphoric acid, and 2 per cent of potash. If the land is known to be well supplied with potash, a 2–12–0 fertilizer[2] will serve the purpose. The nitrogen of the fertilizer should be derived from nitrate of soda or sulphate of ammonia, or preferably both, which provide this plant food in an immediately available form and help to start the plants off quickly. The high content of phosphoric acid supplies the deficiency of that element in the manure, and the 2 per cent of potash furnishes an addition of this ingredient welcome to the potato crop. When the two sources of plant food are used, an application of 10 to 12 tons of farm manure and 600 pounds of a 2–12–2 fertilizer may be depended upon to produce satisfactory results. In the West, where the soils are as a rule abundantly supplied with phosphorus and potash but are deficient in nitrogen and humus, barnyard manures supply the elements necessary to the satisfactory growth of the potato plant.

The use of concentrated fertilizers is spreading rapidly and the day is not far distant when many growers will be using double and even triple strength fertilizers, thereby saving freight charges and the labor involved in handling low-grade goods. (See Farmers' Bulletin 1064.)

MANNER OF APPLICATION

It is usually preferable to apply the manure to fall-plowed land in the late winter or spring and disk it in or to spring-plowed land before plowing. Commercial fertilizers are generally applied in the drill row and well worked into the soil before dropping the seed.

When machine planters having a fertilizer-distributing attachment are used the fertilizer is distributed and the seed planted at a single operation.

[2] See the footnote on p. 6.

SEED DISINFECTION

The disinfection of seed potatoes was primarily undertaken for the prevention of potato scab, but it has since been found that when properly done it is also effective in destroying the resting stage of the black-scurf fungus.[3] The disinfection of seed potatoes to free them from potato scab and black scurf is recommended as a general practice, though it will not prevent either the scab or the black scurf when it is present in the soil and the conditions are favorable for its growth. The seed should be treated before it is cut. The treatment consists in immersing the tubers for a period of from one-half to 1½ hours in a cold corrosive sublimate or formaldehyde solution or from 3 to 5 minutes in a hot solution of the latter. The cold corrosive-sublimate solution is generally admitted to be more effective than the

FIG. 3.—Two 2-ounce Irish Cobbler potato tubers cut in two.

cold formaldehyde solution in destroying black scurf. The solutions are made as follows:

Corrosive-sublimate solution.—Dissolve 4 ounces of corrosive sublimate [mercuric chloride ($HgCl_2$)] in 2 gallons of hot water; then add 28 gallons of cold water. The length of treatment should vary with the condition of the seed tubers; if they are firm and ungerminated, are more or less infected with scab or black scurf, they may be allowed to remain in the solution 1½ to 2 hours, but if germinated or visibly free from surface diseases the period of treatment may be reduced to from one-half to 1 hour.

Formaldehyde solution.—Add 1 pint of formalin (formalin is a trade name representing a 40 per cent solution of formaldehyde gas) to 30 gallons of water for the cold solution, or 2 pints to 30 gallons of hot water. The same period of treatment is recommended in the cold treatment as that given for the corrosive-sublimate treatment. In the case of the hot formaldehyde solution the period is much shorter. With the solution heated to 125° F. the time of treatment should be approximately from four to five minutes. If the potatoes are treated in bulk—that is, loose—it is recommended that on removal from the solution they should be piled up and covered with a blanket or burlap sacks for an hour, after which they should be spread out to dry. If the tubers are sprouted, shorten the time to 3 to 4 minutes.[4]

Corrosive sublimate is an extremely poisonous substance, and every precaution should be taken to prevent farm animals from drinking the solution. Care should be exercised in the use of the vessels afterwards to see that they are thoroughly rinsed out. Being a metallic substance which readily attacks metals, only wooden, earthen, or concrete vessels can be used safely. Owing to the fact

[3] Known as *Rhizoctonia solani*.

[4] At the present time there are at least two patented machines for the treatment of seed potatoes in the hot formaldehyde solution. These machines are equipped with kerosene burners for heating the solution. The kerosene is vaporized by means of a vacuum pressure tank. Community treating tanks are in use in some sections, particularly in Iowa, Kansas, and Missouri; these appear to be satisfactorily solving the problem of seed treatment.

that a considerable quantity of the corrosive sublimate is absorbed by the tubers and the containers in which they are placed, the strength of the corrosive sublimate is quite materially reduced with each treatment; hence it is necessary to renew the solution after three or four lots have been treated in it. This makes it a little more troublesome and expensive than the formaldehyde treatment, for the strength of the latter is not diminished. Seed potatoes, to be effectively treated, should be as free from dirt as possible. The newly treated seed should be spread out to dry as soon as removed from the solution.

QUANTITY OF SEED

Low yields are frequently due to the use of seed too sparingly. According to the Bureau of Agricultural Economics, the average quantity of seed used by the growers of the United States in planting an acre of potatoes is 8.6 bushels. It is believed that better yields would be obtained if from 15 to 18 bushels of seed per acre were used; in fact, under certain conditions there is every reason to suppose that a still larger quantity would be found profitable.

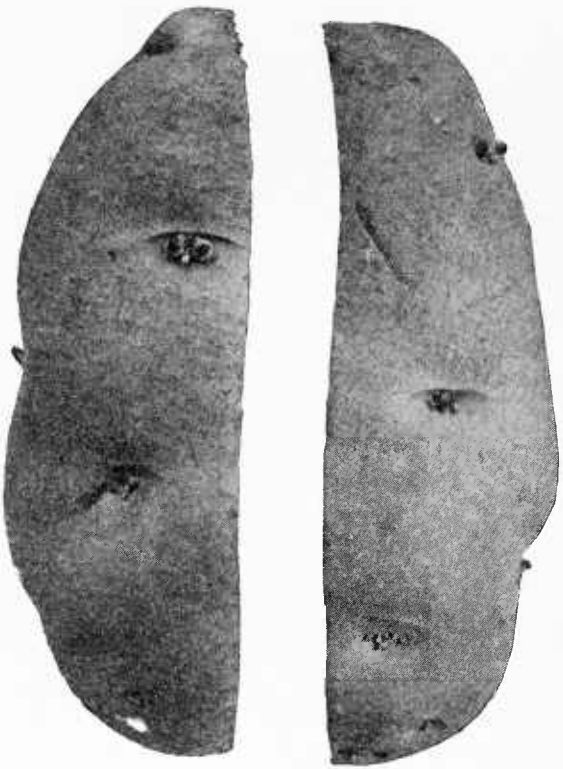

FIG. 4.—First step in cutting a potato tuber into seed pieces or sets

SIZE OF SEED

As a result of many experiments, it has been shown rather clearly that a good-sized seed piece is preferable to a small-sized one. A seed piece containing from one to three eyes and weighing from 1 to 2 ounces (fig. 3) will, if properly spaced, say, 12 to 14 inches, give better results than smaller sized pieces cut to single eyes (figs. 4 and 5). The small-sized seed pieces are more liable to rot if the ground is cold and wet after they are planted and before they have germinated, and they are also more likely to dry up and fail to germinate if the ground is very dry or is poorly prepared. The smaller the size of the seed pieces used, the more thoroughly must the seed bed be prepared and the more favorable must be the growing conditions between the dates of planting and actual germination in order to secure satisfactory results.

CUTTING THE SEED

APPARATUS USED IN CUTTING

In cutting the tubers, aim to make the cuts at right angles to each other, in order to secure blocky rather than wedge-shaped pieces (figs. 3 to 5). Medium-sized tubers, or those running from 2 to 5 ounces in weight, are the most desirable for seed purposes, provided they have been produced by healthy and productive plants. The labor of seed cutting may be materially lessened by rigidly fastening the cutting knife in a vertical position with its cutting edge away from the operator, so that the motion in cutting is a drawing rather than a pushing one. The knife may be fastened in a 2 by 4

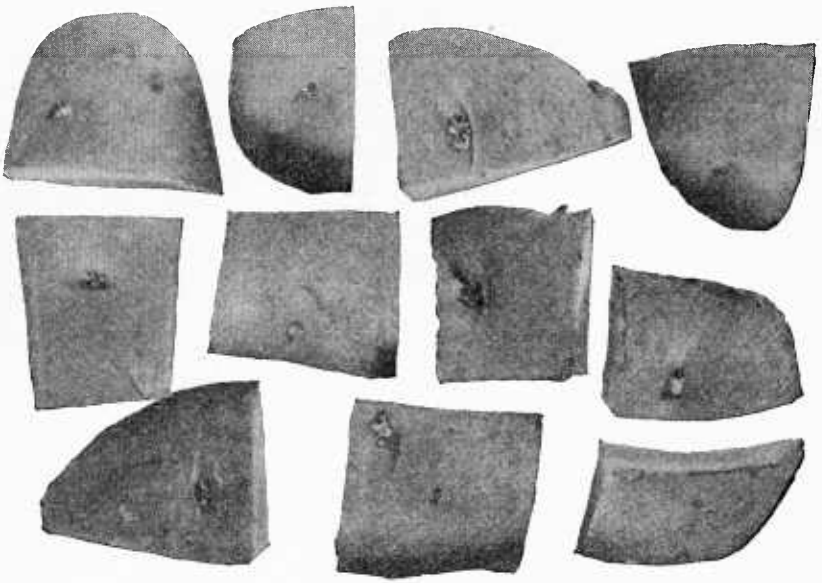

FIG. 5.—Completed operation in cutting the potato tuber shown in Figure 4 into single-eye seed pieces

inch piece of lumber. Where any considerable quantity of seed is to be cut it will pay to construct a cutting box. This consists of a wooden hopper holding a barrel or so of seed potatoes. The bottom of the cutting box is inclined forward sufficiently to cause the potatoes to roll to the front, where they pass through the opening into a small shallow tray as the tubers are removed by the operator for cutting. The knife in this case is fastened to the tray. The cutting box is sufficiently elevated to permit beneath the knife the attachment of a sack into which the cut seed falls (fig. 6).

HANDLING THE CUT SEED

When the seed is planted soon after it is cut, there is little, if any, need of special treatment except that when a planter is to be used the machine will handle the seed pieces better if they are dusted with

land plaster, flowers of sulphur, or air-slaked lime (fig. 7). Where large acreages are to be planted it is often necessary to cut the seed considerably in advance of the date of planting. In such cases the proper curing of the seed is a very important procedure. The improper handling of freshly cut seed has often been responsible for poor stands which have been thought by the growers to be due to poor seed. When not intended for immediate planting, freshly cut seed should be stored in open crates or spread out in a thin layer on the storage-house or room floor and held at a temperature of 60° F. with a high humidity for 7 to 10 days. Under such conditions the cut surfaces of the sets will thoroughly heal over, after which the temperature may be lowered to a point just low enough to hold germination in check. When freshly cut seed is stored in bulk it quickly develops enough heat to injure germination or to prevent it entirely. It is also very injurious to expose freshly cut seed to direct sunlight. An exposure of an hour or two, if the day is warm, is often sufficient to affect very seriously its germinating qualities.

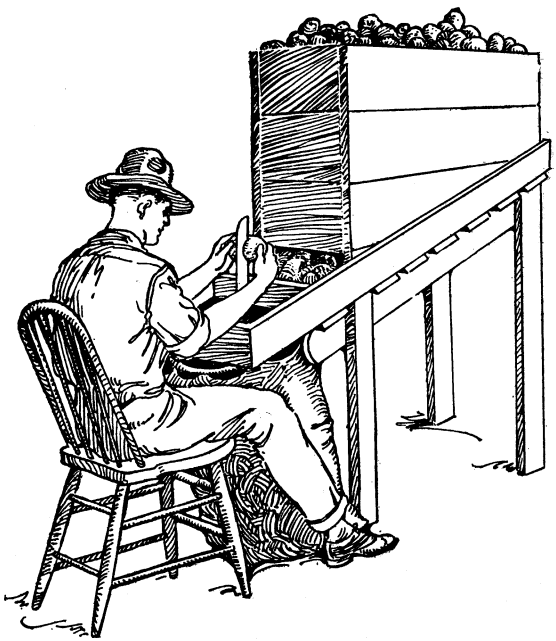

FIG. 6.—A seed-cutting box which greatly reduces the labor of cutting seed potatoes

PLANTING THE SEED

The depth at which the seed pieces should be planted is directly dependent upon the character of the soil and the season of the year in which the crop is planted. In light sandy soil plant the early crop 3 to 4 inches deep and the late crop 4 to 5 inches deep. On heavy types of soil plant early varieties from 2 to 3 inches deep and late ones 3 to 4 inches deep.

The distance at which the crop should be planted for best results is largely governed by the variety grown, the fertility of the soil, and the normal moisture supply. Early varieties, such as the Irish Cobbler, Triumph, and Early Ohio, may be planted in rows from 30 to 34 inches apart and from 10 to 12 inches apart in the row. Late varieties, such as the Green Mountain and the Rural, are ordinarily planted in rows 34 to 36 inches apart, with plants spaced 12 to 14 inches apart in the row.

In regions where the crop is grown under irrigation and ridging is a necessity, the distance between the rows may be as great as 42 inches. Likewise, in sections where the rainfall is light, as in the semiarid regions of the West, and irrigation water is not available, the rows are frequently 48 inches apart and the plants in the row from 24 to 36 inches apart.

TIME OF PLANTING

The early crop should be planted as soon as danger from killing frosts, after the crop is up, is past and the condition of the soil will permit. The soil should be in a good friable condition. It should never be planted when it is wet enough to be sticky; neither should it be planted before it has been sufficiently pulverized to put it in good

FIG. 7.—Planting cut seed potatoes with a 1-row 2-horse planter at Spooner, Wis.

physical condition to receive the seed. In the South the risk from late spring frosts is an ever-present menace, and the grower is obliged to take certain risks in order to bring his crop to marketable maturity at as early a date as possible. In the North it is usually not possible to plant too early, because as a rule the soil can not be put in proper condition to receive the crop. In the South early crop planting may begin the latter part of November in southern Florida, ending in early April in Maryland and Delaware. In the Northern States the early crop is planted from the latter part of March to the latter part of May. Late-crop planting begins in the North in May and extends into the early part of September in the extreme South.

CROP PERIODS

Seasonally speaking, potato planting may be divided into four more or less distinct crop periods, viz, (1) the early (or truck) crop of the South, (2) the early crop of the North, (3) the late crop of the North, and (4) the late crop of the South; in fact, the late crop of the South might be subdivided into the production of second-crop potatoes and late or fall crop potatoes. The early (or truck) crop of the South is largely marketed in the North and West, whereas the early crop of the North is largely grown to supply local markets. The late crop of the North is grown for fall, winter, and spring consumption and is widely distributed. Much of the late crop grown in

FIG. 8.—First deep cultivation of potatoes with a 2-horse riding cultivator, Churchland, Va.

the South is marketed locally. Virginia and Maryland may be regarded as exceptions to the above statement.

Second-crop production in the South is of special interest to potato growers, because it really involves two quite distinct practices. The first consists in the growing of a second crop from seed obtained from the first crop. This in our judgment is the only true second-crop potato production. The second practice consists in planting seed of the preceding year's crop (generally northern-grown seed) that has been held over in cold storage until required for use. This practice does not differ essentially from that involved in the growing of a late southern crop, except that it is usually grown to furnish seed stock for the next season's crop. The chief points of interest to the grower in the production of second-crop potatoes from seed produced by the early crop are those pertaining to the handling of the seed [4] and the localities where the crop is grown. The bulk of real second-crop

[4] Detailed information in regard to the handling of first-crop seed for second-crop planting may be found in Farmers' Bulletin 1205, Potato Production in the South, pp. 33 to 35.

potatoes is produced in Oklahoma, Arkansas, Texas, and to some extent in Louisiana. In other localities, as in the celebrated Louisville (Ky.) district, North Carolina, South Carolina, Virginia, and Maryland, the second crop is grown usually from stock held over from the preceding year.

GOOD TILLAGE

OBJECTS OF TILLAGE

The objects of tillage are to prevent weed growth, conserve moisture, aerate the soil, increase the available supply of plant food, and stimulate root action. The aim of the grower should be to keep the surface

FIG. 9.—First cultivation of potatoes just before the plants break through the ground. The loose soil is ridged up, as shown in Figure 10

soil loose and open from the time of planting the crop until the damage from root injury is greater than the benefit derived by the plant from the loosening of the surface soil. Much hand hoeing may be avoided by early cultivations with a spike-tooth harrow or a weeder run lengthwise of the rows. Cultivation may be continued with the harrow until after the plants are well above ground, provided it is so constructed that the teeth can be slanted backward. As soon as the plants are up they should receive as deep a cultivation as it is possible to give (fig. 8). At this stage of development the cultivator can be run quite close to the plants without injury to them. The next cultivation should be shallower and farther from the plants. The same rule should be observed for each subsequent cultivation. Frequency of tillage should be governed by seasonal conditions. A safe general rule to follow is to cultivate the crop whenever the soil needs it—that is, whenever a crust forms on the surface or weeds begin to grow. Weeds should never be permitted to take possession of the land.

COMPARISON OF RIDGE AND LEVEL CULTURE

Two rather distinct cultural practices obtain in the growing of a crop, viz, the ridge method and the level-culture method. In the ridge method the soil after each cultivation between the rows (fig. 9) is ridged up around the plants by means of a wing or disk potato hoe, which pushes or throws the soil up around the plants (fig. 10). In the level-culture method the aim is to keep the soil

FIG. 10.—Ridging the soil with a 2-row disk potato hoe, Aroostook County, Me.

level, or nearly so. Generally at the last cultivation the side shovels are set so as to throw some soil toward the plants, to protect the tubers near the surface from sunburn. The ridge method is practiced in Maine and certain other parts of New England, New York, Pennsylvania in part, the South generally, and the irrigated sections of the West. Level culture is largely practiced in Ohio, Indiana, Michigan, Wisconsin, Minnesota, and the Dakotas. With the ridge system of culture, cultivation can be continued somewhat later in the season than with level culture, because few of the roots of the ridged plants extend beyond the ridge; hence tillage in the center of the row and ridging up the loose soil does not injure the roots, as in level culture, where they spread out through the adjacent soil.

POTATO DISEASES [5]

For the sake of convenience, the common diseases of the potato are presented in tabular form, and the nature of the injury and remedy or preventive measure to employ are indicated. (Table 2.)

[5] For more detailed information concerning the control of fungous and insect pests of the potato plant and tuber, the reader is referred to Farmers' Bulletins 868 and 1367, entitled "How to Increase the Potato Crop by Spraying" and "Control of Potato-Tuber Diseases."

TABLE 2.—*Common diseases of the potato; also preventive measures*

Name of the disease	Injury to—	Remedy or preventive measures
Early-blight	Leaves, stems, and tubers	Spray with Bordeaux mixture; plant disease-free seed.
Late-blight		
Fusarium blight	Roots, stem, and tubers	Plant clean seed; rotate crops.
Rhizoctonia scab	do	Plant clean or disinfected seed.
Verticillium wilt	Stem and tubers	Plant disease-free seed; rotate crops.
Mosaic	Foliage, stem, and tubers	Plant disease-free seed.
Leaf-roll	Leaves, stems, and tubers	Do.
Common scab	Tubers and to some degree the roots.	Disinfect the seed tubers as previously directed and avoid soils known to produce scabby potatoes.

INSECT AND EELWORM PESTS

The potato has its full share of insect pests. Some of these enemies attack the foliage or the stem of the plant, while others attack the roots and the tuber. For the sake of convenience they may be divided into the following groups: (1) Chewing, (2) sucking, and (3) piercing or tunneling insects. The first division includes the Colorado potato beetle, the old-fashioned potato beetle, or blister beetle, and the flea beetle. The second division includes the plant louse, or aphid, and the potato leafhopper. The third division embraces flea-beetle larvæ, the potato tuber moth, and the eelworm. The latter, however, is an animal rather than an insect parasite.

The first two leaf-chewing insects are easily controlled by spraying the plants with arsenical poisons. The flea beetle is more difficult to control, as it eats very much less of the foliage. It is most effectively controlled by keeping the foliage well covered with Bordeaux mixture to which an arsenical poison has been added. The Bordeaux spray acts as a repellent by making the foliage distasteful to the flea beetle.

The plant louse and potato leafhopper, on account of the way they obtain their nourishment from the plant—that is, by sucking its juices—can not be destroyed by applying poison to the foliage. The only effective way of controlling these two pests is by thoroughly spraying the plants with a contact insecticide, such as nicotine-sulphate solution (40 per cent nicotine) or with kerosene emulsion.[6] Effective control of these two insect pests is largely dependent upon the early spraying of the plants and the thoroughness with which the work is done. To be effective the under side of the leaves must be more thoroughly sprayed than the upper, because the insects congregate on the lower side. The potato leafhopper is a comparatively new potato insect pest, at least it has only recently attracted the attention of the entomologist and the potato grower. It is claimed that thorough spraying with Bordeaux mixture in connection with nicotine-sulphate solution (40 per cent nicotine) serves as a repellent.

Injury from these two pests is largely confined to the northeastern United States. The potato leafhopper is especially troublesome in the Middle West.

[6] Nicotine-sulphate solution (40 per cent nicotine) may be used at the rate of 1 pint to 100 gallons of water. Kerosene emulsion is made by dissolving one-half pound of hard soap or whale-oil soap in a gallon of boiling hot water and when still hot adding 2 gallons of kerosene oil. This mixture should be churned into itself by means of a small hand pump uutil the solution is completely emulsified.

The potato tuber moth is largely restricted to California. It attacks leaves, stems, and tubers and in some localities causes very material loss. Preventive measures, such as crop rotation, destruction of old potato plants, and prompt harvesting and disposal or storage of the crop as soon as dug, help to minimize the injury. Tubers containing the larvæ of the tuber moth or that carry eggs on their surface when stored should be fumigated with carbon disulphid at least twice to prevent further increase of the insects as well as to destroy those present in or on the tuber. For fuller information consult United States Department of Agriculture Bulletin 427, The Potato Tuber Moth (p. 50).

The eelworm is an animal parasite. It is widely distributed, but as a rule is not a serious pest of potatoes, except in certain portions of the Pacific coast region, particularly in parts of California, and in the Southern States. As the eelworm lives over in the roots of many plants and confines its attacks to the roots and tubers of the potato plant, it is not possible to destroy it with arsenical poisons or contact sprays. Crop rotations, soil sanitation, and the use of clean seed are recommended as preventive measures.

SPRAYING THE PLANTS

SPRAY MIXTURES

Strong, vigorous plants are dependent in no small measure upon the degree of protection given them by thorough spraying with fungicides or insecticides, or both, throughout the growing season. Spray with Bordeaux mixture for the control of early blight and late blight. Begin spraying the plants with Bordeaux mixture as soon as they are 6 to 8 inches high. Add Paris green, arsenate of lead, arsenate of calcium, or arsenite of zinc to the Bordeaux spray whenever the bugs become injurious. An acre of potatoes can be easily sprayed by hand, but if a power sprayer is available it will be found more economical to use it. Of the strictly hand sprayers, the autospray and the knapsack sprayer are the best types. The barrel spray pump is the most efficient hand-operated spray apparatus. It requires two men to operate it satisfactorily. Where the early-blight and the late-blight do not prevail, spraying with Bordeaux mixture is unnecessary except for control of potato leaf hoppers.

The formulas for Bordeaux mixture, arsenical poisons, etc., are as follows:

Bordeaux mixture.—Dissolve 5 pounds of copper sulphate in 20 gallons of water. Slake 5 pounds of lime in water and dilute to 20 gallons. Pour the copper sulphate and lime solutions together, stirring thoroughly. Add water to make 50 gallons.

Arsenical poisons.—(1) Paris green, 8 to 12 ounces; slaked lime, 2 pounds; water to make 50 gallons.

(2) Arsenate of lead paste, 3 to 5 pounds; water to make 50 gallons.

(3) Arsenite of zinc, 1 to 2 pounds; water to make 50 gallons.

Contact insecticides.—Nicotine-sulphate solution (40 per cent nicotine); 1 pint to 100 gallons of water.

Kerosene emulsion: One-half pound of hard soap or whale-oil soap; 1 gallon of boiling water; 2 gallons of kerosene oil. Dilute to 50 gallons.

Gaseous insecticides.—Carbon disulphid, 2 pounds to 1,000 cubic feet. Expose 48 hours.

When the Paris green is used with the Bordeaux mixture, no further lime is necessary.

NUMBER OF SPRAYINGS

Spray as often as may be necessary to keep the foliage well covered with fungicide or insecticide as long as there is apparent danger. This may be two, four, six, eight, or more times, depending on whether one is in a late-blight infected area and if the season is favorable to the development of the disease. A serious infection of late-blight has been observed after September 15 in western New York.

When full grown it will require from 100 to 125 gallons of Bordeaux mixture to cover the foliage of an acre of plants thoroughly.

FIG. 11.—Selecting well-shaped potato tubers in the field

ROGUING AND SELECTING FOR SEED

Where it is possible to produce good seed potatoes—that is, in localities where the climatic conditions are favorable to the development of good strong seed stock—a portion or all of the acre should be carefully gone over during the growing season and all diseased or weak plants or mixtures pulled out. Especially promising looking plants should be marked and dug separately before the rest are harvested. The progeny of these plants should be kept for seed. The best of these selections should be saved the following year and should eventually furnish high-grade seed stock for the acre plat (fig. 11). High-grade seed stock can be maintained only through a continuous process of selection (fig. 12).

HARVESTING THE CROP

The easiest way to harvest the crop is to dig it with a horse-drawn elevator digger (fig. 13). The next easiest is to use a digger plow, with rocking fingerlike attachment, to separate the tubers from the soil. It is less easy to plow them out with a 1 or 2 horse turnplow,

and the hardest way from a physical-labor standpoint is to dig them by hand (fig. 14).

Seed for next year's crop should be selected at digging time. Avoid all inferior-looking tubers, and, as far as may be, take tubers from productive plants only. Slat crates make very convenient receptacles for the storing of seed potatoes. After selecting the desired quantity of seed the remainder of the crop may be all picked up together and put into the storage house or cellar for sorting later or graded into marketable and unmarketable stock and sold direct from the field.

GRADING

The establishment of standard potato grades is an outcome of the late World War. We now have four standard grades of potatoes: U. S. Fancy No. 1, U. S. No. 1, U. S. No. 1 Small, and U. S. No. 2. The first has recently been established to meet the demands of cer-

FIG. 12.—Studying type specimens of potatoes, an essential in learning the good as well as the undesirable characteristics of a variety

tain western growers who wish to put up a fancy or select grade.

Descriptions of these grades may be found in United States Department of Agriculture Circular 238.

STORAGE

The object of storing any product is to preserve its quality during as long a period as may be necessary or possible in order to permit its disposal at the most advantageous time. The temperature best suited to the proper preservation of potatoes is one ranging from 36° to 40° F. The best results will be secured if the newly harvested potatoes are subjected to a temperature of 50° to 60° F. and a rather high humidity for a period of 10 days or 2 weeks prior to storing at the lower temperature mentioned. This insures proper healing of injured surfaces of the potato.

For further information on storage see Farmers' Bulletin 847.

Do not store potatoes in large piles when they are moist or covered with moist earth, as they quickly develop sufficient heat to injure the vitality of the tubers. If, through unfavorable weather conditions, it becomes necessary to store potatoes when they are wet and dirty, spread them out in a thin layer until they have become dry, after which they may be piled up. It is not desirable to store potatoes to a greater depth than 6 feet.

Potatoes intended for table use should always be stored in a darkened cellar or storage house. Exposure to light quickly injures the quality for food purposes.

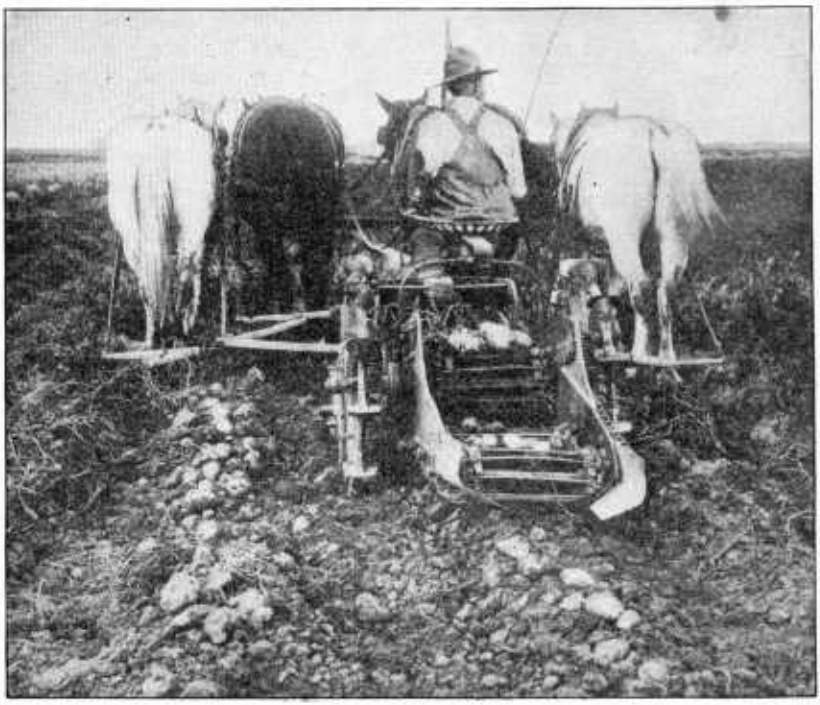

FIG. 13.—A horse-drawn elevator potato digger. This implement harvests the crop, leaving the tubers on the surface of the ground

SUMMARY

The average production in the United States during the years 1926 to 1930 was 112.9 bushels per acre, while during the same period that in the State of Maine was 250.3 bushels.

Commercial yields of 500 to 600 bushels per acre are by no means uncommon, and on small areas much larger yields have been secured by members of boys' and girls' agricultural clubs.

Intensive rather than extensive production is necessary under present economic conditions. Increased production per acre at a reduced cost per bushel should be the goal of every progressive potato grower in the United States. Increased production per acre is dependent upon many factors.

A suitable soil is important; gravelly or sandy loam soils are best. Clover or alfalfa is a good preparatory crop. The soil should be

well plowed and thoroughly pulverized before the crop is planted. Fall plowing and spring plowing each has its advocates. As a rule, fall plowing is the more desirable.

The selection of the right variety is an important step in the production of a good crop. An early variety should be selected for the early market and a late or medium-late maturing one for autumn and winter consumption.

The available plant-food supply in the soil or applied to the crop is one of the main determining factors as to the yield secured. The plants must be well fed if they are to produce a large crop of tubers.

Different percentages of the three chemical elements, nitrogen (ammonia), phosphoric acid, and potash, should be applied to different types of soil to secure the best results.

FIG. 14.—Digging potatoes by hand. This is the hardest way to harvest the crop, but if carefully done it causes the least mechanical injury to the tubers, and when the diggers leave the progeny of each hill by itself the process of selecting seed stock by hills may be employed

High-grade seed stock must be used if a large crop is to be harvested.

Different strains of seed of the same variety vary greatly in their productive capacity. Every effort should be made to secure high-yielding seed stock.

All seed stock should be disinfected in a formaldehyde or corrosive-sublimate solution before cutting.

As a rule, the quantity of seed planted is too small to produce maximum acre yeilds.

Seed pieces weighing from 1 to 2 ounces and containing from one to three eyes will give better acre yields than smaller sized pieces cut to single eyes.

The seed piece should be so cut as to give a blocky rather than a wedge shape.

The depth of planting should be varied to conform to the character of the soil and the season of the year.

The spacing of the rows and of the plants in the row is dependent upon the variety, the climate, and the character of the soil.

The time of planting is naturally governed by the disposition to be made of the crop; also by the weather conditions.

Seasonally speaking, there are four crop periods: (1) The early (or truck) crop of the South, (2) the early crop of the North, (3) the late crop of the North, and (4) the late crop of the South.

The late crop of the South should be subdivided into (1) the planting of early-maturing varieties in midsummer for the purpose of producing second-crop seed to be used in the planting of the early crop the ensuing year and (2) the planting of late-maturing varieties for fall and winter consumption.

Good tillage is necessary if a good crop is to be harvested.

Potato diseases may be controlled by the rigid removal of all diseased seed tubers, by treatment of tubers used for seed, by spraying the foliage, and by roguing out diseased plants.

Potato plants must be protected from insect injury if large yields are to be secured. Leaf-chewing insects may be controlled by arsenical poisons; sucking insects by contact insecticides.

Well-graded potatoes will always bring a better price than poorly graded ones.

A good storage house or cellar is necessary if the potato crop is to be held for winter or spring marketing.

Light is injurious to the table quality of the potato.

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